

CLAIMS

1. A curable composition characterized by comprising:

an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof; and

a silicate (B).

2. The curable composition according to claim 1, characterized in that the silicate is a condensate of a tetraalkoxysilane.

3. The curable composition according to claim 1 or 2, characterized by further comprising a tin carboxylate (C).

4. A curable composition characterized by comprising:

an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof; and

a tin carboxylate (C1) in which the α -carbon of the carboxyl group is a quaternary carbon atom.

5. A curable composition characterized by comprising:

an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing

functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof;

 a tin carboxylate (C); and
 an organotin catalyst (D).

6. A curable composition characterized by comprising:

 an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof; and

 a non-tin catalyst (E).

7. The curable composition according to claim 6, characterized in that the non-tin catalyst is one or more selected from a carboxylic acid, a metal carboxylate other than a tin carboxylate and an organic titanate.

8. The curable composition according to claim 6, characterized in that the non-tin catalyst is a catalyst which comprises a carboxylic acid and an amine compound.

9. The curable composition according to claim 7 or 8, characterized in that the carboxylic acid is a carboxylic acid in which the α -carbon atom of the carboxyl group is a quaternary carbon atom.

10. A curable composition characterized by comprising:

 an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing

functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof; and

a microballoon (F).

11. A curable composition characterized by comprising:

an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof, and the proportion of said organic polymer in the total amount of the curable composition being 5 to 28 wt%.

12. The curable composition according to any one of claims 1 to 11, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (1):



where X represents a hydroxy group or a hydrolyzable group, and three X's may be the same or different.

13. The curable composition according to any one of claims 1 to 12, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a trimethoxysilyl group or a triethoxysilyl group.

14. The curable composition according to any one of claims 1 to 12, characterized in that the one or more silicon-containing

functional groups capable of cross-linking by forming siloxane bonds each are a group represented by the general formula (2) :



where three R¹'s each are independently a monovalent organic group having 2 to 20 carbon atoms.

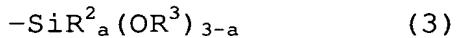
15. A curable composition characterized by comprising:

an organic polymer (A2) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are represented by the general formula (2) :



where R¹'s are the same as described above; and

an aminosilane coupling agent (G) having a group represented by the general formula (3) :



where a R²'s each are independently a monovalent organic group having 1 to 20 carbon atoms, (3-a) R³'s each are independently a monovalent organic group having 2 to 20 carbon atoms, and a represents 0, 1 or 2.

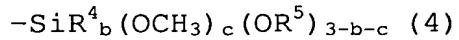
16. A curable composition characterized in that the curable composition is obtained by aging a composition comprising:

an organic polymer (A2) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are represented by the general formula (2) :



where R¹'s are the same as described above; and

an aminosilane coupling agent (H) having a group represented by the general formula (4):



where b R⁴'s each are independently a monovalent organic group having 1 to 20 carbon atoms, (3-b-c) R⁵'s each are independently a monovalent organic group having 2 to 20 carbon atoms, b represents 0, 1 or 2, and c represents 1, 2 or 3; the relation, 3-b-c ≥ 0, is to be satisfied.

17. A curable composition characterized by comprising:

an organic polymer (A2) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are represented by the general formula (2):



where R¹'s are the same as described above; and

an epoxy resin (I).

18. A curable composition characterized by comprising a polyoxyalkylene polymer (A3) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are represented by the general formula (2):



where R¹'s are the same as described above; and

a (meth)acrylate copolymer (A4) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds.

19. The curable composition according to claim 18, characterized in that the one or more silicon-containing functional groups of the (meth)acrylate copolymer are the groups represented by the general formula (2) :



where R¹'s are the same as described above.

20. A curable composition characterized by comprising a saturated hydrocarbon polymer (A5) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are represented by the general formula (2) :



where R¹'s are the same as described above.

21. A curable composition characterized by comprising a (meth)acrylate copolymer (A6) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are represented by the general formula (2) :



where R¹'s are the same as described above.

22. The curable composition according to any one of claims 14 to 21, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated

groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (5):



where R¹'s are the same as described above.

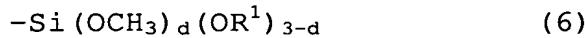
23. The curable composition according to any one of claims 1 to 22, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer which substantially does not contain an amide segment (-NH-CO-) in the main chain skeleton thereof.

24. The curable composition according to any one of claims 1 to 23, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a triethoxysilyl group.

25. The curable composition according to any one of claims 1 to 14 and 17 to 24, characterized by further comprising an aminosilane coupling agent.

26. A one-part curable composition according to any one of claims 1 to 25, characterized by further comprising a dehydrating agent.

27. A method for producing an organic polymer having a group represented by the general formula (6):



where (3-d) R¹'s each are independently a monovalent organic group having 2 to 20 carbon atoms, and d represents 1, 2 or 3, characterized in that an organic polymer (A2) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable

of cross-linking by forming siloxane bonds are represented by the general formula (2) :



where R¹'s are the same as described above, is made to undergo ester exchange reaction with a compound (J) having at least one methoxy group capable of undergoing ester exchange reaction.

28. An adhesive for panel, characterized in that the adhesive comprises an organic polymer (A) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds; and a silicate (B).

29. An adhesive for panel characterized by comprising an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof.

30. The adhesive for panel according to claim 29, characterized by using a curable composition in which the main chain of the organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is a (meth)acrylate copolymer produced by a living radical polymerization method.

31. The adhesive for panel according to claim 29 or 30, characterized by further comprising a silicate (B).

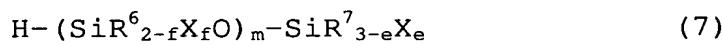
32. The adhesive for panel according to any one of claims 29 to 31, characterized by further comprising a tin carboxylate (C).

33. The adhesive for panel according to any one of claims 29 to 32, characterized by further comprising an organotin catalyst (D).

34. An adhesive for panel characterized in that an organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer (A7) which has on average 1.7 to 5 silicon-containing functional groups capable of cross-linking by forming siloxane bonds per molecule.

35. The adhesive for panel according to claim 34, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a silicon-containing functional group having three or more hydrolyzable groups on the one or more silicon atoms thereof.

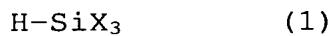
36. The adhesive for panel according to claim 28 or 34, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (7):



where R^6 and R^7 may be the same or different, and each are an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, an aralkyl group having 7 to 20 carbon atoms, or a triorganosiloxy group represented by $(R')_3SiO-$; when two or more R^6 or R^7 are present, they may be the same or different; wherein, R' represents a monovalent hydrocarbon group having 1 to 20 carbon atoms, and three R' 's may be the same or different; X represents a hydroxy group or a hydrolyzable group; when two or more X 's are present,

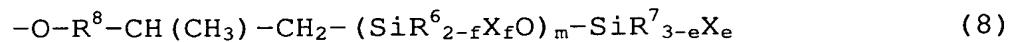
they may be the same or different; e represents 0, 1, 2 or 3; f represents 0, 1 or 2; f's in m $(SiR^{6-2-f}X_fO)$ groups may be the same or different; m represents an integer of 0 to 19; and the relation, $e + \Sigma f \geq 1$, is to be satisfied.

37. The adhesive for panel according to any one of claims 29, 30, 31, 32, 33 and 35, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (1):



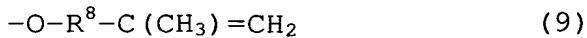
where X's are the same as described above.

38. An adhesive for panel characterized in that an organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer (A8) having a structural moiety represented by the general formula (8):

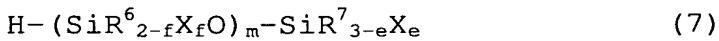


where R^8 represents a divalent organic group having 1 to 20 carbon atoms and containing as constituent atoms one or more selected from the group consisting of hydrogen, oxygen and nitrogen; and R^6 , R^7 , X, e, f and m are the same as described above.

39. The adhesive for panel according to claim 38, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced thereinto, represented by the general formula (9):

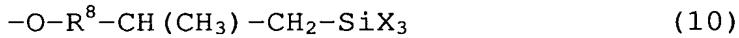


where R^8 is the same as described above, and a hydrosilane compound represented by the general formula (7) :



where R^6 , R^7 , X , e , f and m are the same as described above.

40. The adhesive for panel according to claim 38 or 39, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer having a structural moiety represented by the general formula (10) :



where R^8 and X 's are the same as described above.

41. The adhesive for panel according to any one of claims 28 to 40, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer which substantially does not contain an amide segment ($-\text{NH}-\text{CO}-$) in the main chain skeleton thereof.

42. The adhesive for panel according to any one of claims 28 to 41, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a group represented by the general formula (2) :



where R^1 's are the same as described above.

43. The adhesive for panel according to any one of claims 28 to 42, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a triethoxysilyl group.

44. A sealant for working joint in building, characterized in that the sealant comprises an organic polymer (A) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds; and a silicate (B).

45. A sealant for working joint in building characterized by comprising:

an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a silicon-containing functional group having three or more hydrolyzable groups on the one or more silicon atoms thereof.

46. The sealant for working joint in building according to claim 45, characterized by using a curable composition in which the main chain of the organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is a (meth)acrylate copolymer produced by a living radical polymerization method.

47. The sealant for working joint in building according to claim 45 or 46, characterized by further comprising a silicate (B).

48. The sealant for working joint in building according to any one of claims 45 to 47, characterized by further comprising a tin carboxylate (C).

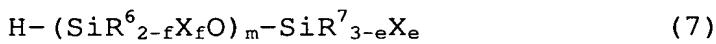
49. The sealant for working joint in building according to any one of claims 45 to 48, characterized by further comprising an organotin catalyst (D).

50. A sealant for working joint in building characterized in that an organic polymer having one or more silicon-containing functional

groups capable of cross-linking by forming siloxane bonds is an organic polymer (A7) which has on average 1.7 to 5 silicon-containing functional groups capable of cross-linking by forming siloxane bonds per molecule.

51. The sealant for working joint in building according to claim 50, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a silicon-containing functional group having three or more hydrolyzable groups on the one or more silicon atoms thereof.

52. The sealant for working joint in building according to claim 44 or 50, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (7):



where R⁶ and R⁷ may be the same or different, and each are an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 20 carbon atoms, an aralkyl group having 7 to 20 carbon atoms, or a triorganosiloxy group represented by (R')₃SiO-; when two or more R⁶ or R⁷ are present, they may be the same or different; here, R' represents a monovalent hydrocarbon group having 1 to 20 carbon atoms, and three R's may be the same or different; X represents a hydroxy group or a hydrolyzable group; when two or more X's are present, they may be the same or different; e represents 0, 1, 2 or 3; f represents 0, 1 or 2; f's in m (SiR^{6-2-f}X_fO) groups may be the same or different;

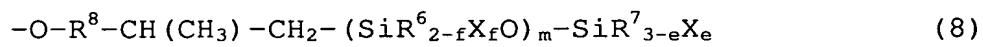
m represents an integer of 0 to 19; and the relation, $e + \Sigma f \geq 1$, is to be satisfied.

53. The sealant for working joint in building according to any one of claims 45, 46, 47, 48, 49 and 51, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (1) :



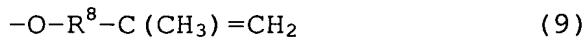
where X's are the same as described above.

54. A sealant for working joint in building characterized in that an organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer (A8) having a structural moiety represented by the general formula (8) :

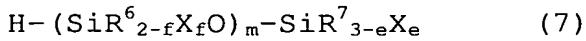


where R^8 represents a divalent organic group having 1 to 20 carbon atoms and containing as constituent atoms one or more selected from the group consisting of hydrogen, oxygen and nitrogen; and R^6 , R^7 , X , e , f and m are the same as described above.

55. The sealant for working joint in building according to claim 54, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced thereinto, represented by the general formula (9) :

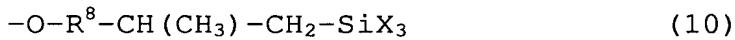


where R^8 is the same as described above, and a hydrosilane compound represented by the general formula (7) :



where R^6 , R^7 , X , e , f and m are the same as described above.

56. The sealant for working joint in building according to claim 54 or 55, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer having a structural moiety represented by the general formula (10) :



where R^8 and X 's are the same as described above.

57. The sealant for working joint in building according to any one of claims 44 to 56, characterized in that the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer which substantially does not contain an amide segment ($-\text{NH}-\text{CO}-$) in the main chain skeleton thereof.

58. The sealant for working joint in building according to any one of claims 44 to 57, characterized in that the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a group represented by the general formula (2) :



where R^1 's are the same as described above.

59. The sealant for working joint in building according to any one of claims 44 to 58, characterized in that the one or more

silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a triethoxysilyl group.

60. A method for controlling the recovery properties, durability and creep resistance of a cured article, characterized by using a curable composition which comprises an organic polymer (A) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds; and a silicate (B).

61. A method for controlling the recovery properties, durability and creep resistance of a cured article, characterized by using a curable composition comprising an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a silicon-containing functional group having three or more hydrolyzable groups on the one or more silicon atoms thereof.

62. The method for controlling the recovery properties, durability and creep resistance of a cured article according to claim 61, characterized by using a curable composition in which the main chain of the organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is a (meth)acrylate copolymer produced by a living radical polymerization method.

63. The method for controlling the recovery properties, durability and creep resistance of a cured article according to claim 61 or 62, characterized by using a curable composition further comprising a silicate (B).

64. The method for controlling the recovery properties, durability and creep resistance of a cured article according to any one of claims 61 to 63, characterized by using a curable composition further comprising a tin carboxylate (C).

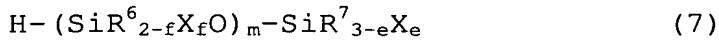
65. The method for controlling the recovery properties, durability and creep resistance of a cured article according to any one of claims 61 to 64, characterized by using a curable composition further comprising an organotin catalyst (D).

66. A method for controlling the recovery properties, durability and creep resistance of a cured article characterized by using a curable composition in which an organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer (A7) which has on average 1.7 to 5 silicon-containing functional groups capable of cross-linking by forming siloxane bonds per molecule.

67. The method for controlling the recovery properties, durability and creep resistance of a cured article according to claim 66, characterized by using a curable composition in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof.

68. The method for controlling the recovery properties, durability and creep resistance of a cured article according to claim 60 or 66, characterized by using a curable composition in which the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer

having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (7) :



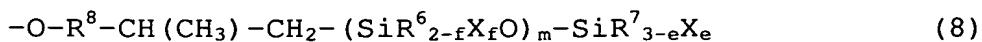
where R^6 , R^7 , X , e , f and m are the same as described above.

69. The method for controlling the recovery properties, durability and creep resistance of a cured article according to any one of claims 61, 62, 63, 64, 65 and 67, characterized by using a curable composition in which the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced into the terminals thereof and a hydrosilane compound represented by the general formula (1) :



where X represents a hydroxy group or a hydrolyzable group, and three X 's may be the same or different.

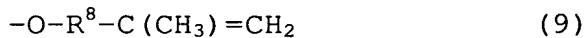
70. A method for controlling the recovery properties, durability and creep resistance of a cured article, characterized by using a curable composition in which an organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer (A8) having a structural moiety represented by the general formula (8) :



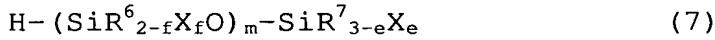
where R^6 , R^7 , R^8 , X , e , f and m are the same as described above.

71. The method for controlling the recovery properties, durability and creep resistance of a cured article according to claim 70, characterized by using a curable composition in which the organic

polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer obtained by an addition reaction between an organic polymer having one or more unsaturated groups introduced thereinto, represented by the general formula (9):

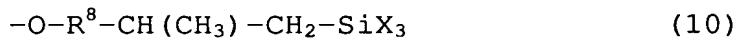


where R^8 is the same as described above, and a hydrosilane compound represented by the general formula (7):



where R^6 , R^7 , X , e , f and m are the same as described above.

72. The method for controlling the recovery properties, durability and creep resistance of a cured article according to claim 70 or 71, characterized by using a curable composition in which the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer having a structural moiety represented by the general formula (10):

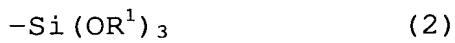


where R^8 and X 's are the same as described above.

73. The method for controlling the recovery properties, durability and creep resistance of a cured article according to any one of claims 60 to 72, characterized by using a curable composition in which the organic polymer having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds is an organic polymer which substantially does not contain an amide segment ($-\text{NH}-\text{CO}-$) in the main chain skeleton thereof.

74. The method for controlling the recovery properties, durability and creep resistance of a cured article according to any one of claims

60 to 73, characterized by using a curable composition in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a group represented by the general formula (2):



where three R¹'s each are independently a monovalent organic group having 2 to 20 carbon atoms.

75. The method for controlling the recovery properties, durability and creep resistance of a cured article according to any one of claims 60 to 74, characterized by using a curable composition in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds each are a triethoxysilyl group.

76. A method for improving thin-layer curability, characterized by using a curable composition comprising:

an organic polymer (A1) having one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds in which the one or more silicon-containing functional groups capable of cross-linking by forming siloxane bonds are silicon-containing functional groups each having three or more hydrolyzable groups on one or more silicon atoms thereof; and

an organotin catalyst (D).